1. (a) Factorize $x^2 - 3x - 10$.

(b) Solve the equation $x^2 - 3x - 10 = 0$.

Working:

Answers:

(a) .....
...

(b) .....
...

(Total 4 marks)

2. Find the sum of the arithmetic series

$17 + 27 + 37 + ... + 417$.

Working:

Answer:

.....
..

(Total 4 marks)

3. Let $f(x) = a(x - 4)^2 + 8$.

(a) Write down the coordinates of the vertex of the curve of f.

(b) Given that $f(7) = -10$, find the value of a.

(c) Hence find the y-intercept of the curve of f.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

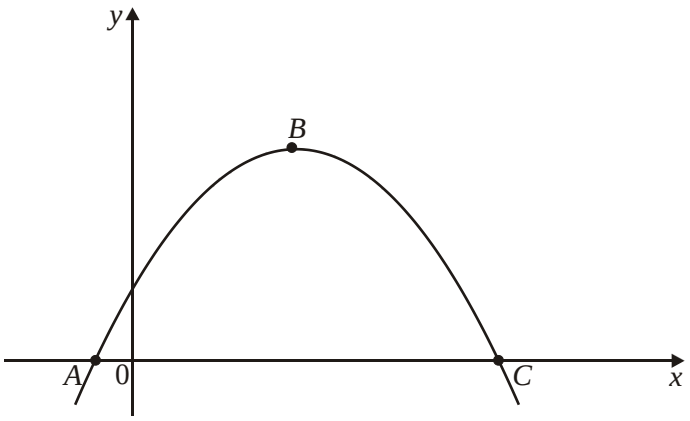
.....

.....

.....

(Total 6 marks)

4. The diagram shows the parabola $y = (7 - x)(1 + x)$. The points A and C are the x-intercepts and the point B is the maximum point.



Find the coordinates of A, B and C.

Working:

Answer:

.....

(Total 4 marks)

5. Consider the arithmetic sequence 2, 5, 8, 11, ...

(a) Find u_{101}.

(3)

(b) Find the value of n so that $u_n = 152$.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

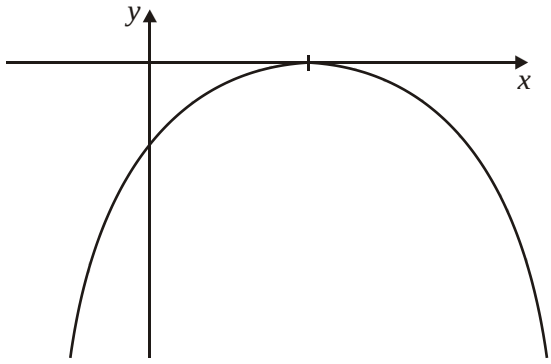
.....

.....

.....

(Total 6 marks)

6. The diagram shows the graph of the function $y = ax^2 + bx + c$.



Complete the table below to show whether each expression is positive, negative or zero.

Working:

(Total 4 marks)

7. Let $f(x) = \log_a x$, $x > 0$.

(a) Write down the value of

(i) $f(a)$;

(ii) $f(1)$;

(iii) $f(a^4)$.

.....

.....

.....

.....

.....

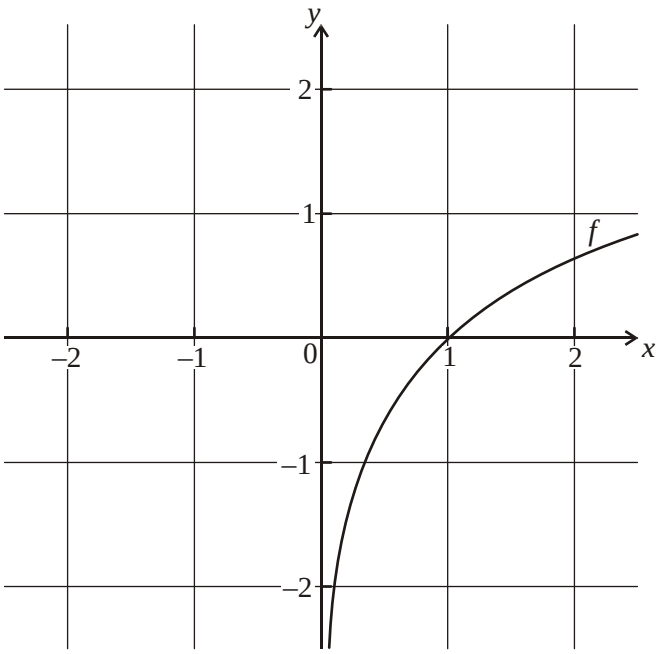
.....

.....

.....

(3)

(b) The diagram below shows part of the graph of f.



On the same diagram, sketch the graph of f^{-1}.

(3)

(Total 6 marks)

8. Let $f(x) = 3(x + 1)^2 - 12$.

(a) Show that $f(x) = 3x^2 + 6x - 9$.

(2)

(b) For the graph of f

(i) write down the coordinates of the vertex;

(ii) write down the **equation** of the axis of symmetry;

(iii) write down the y-intercept;

(iv) find both x-intercepts.

(8)

(c) **Hence** sketch the graph of f.

(2)

(d) Let $g(x) = x^2$. The graph of f may be obtained from the graph of g by the two transformations:

a stretch of scale factor t in the y-direction

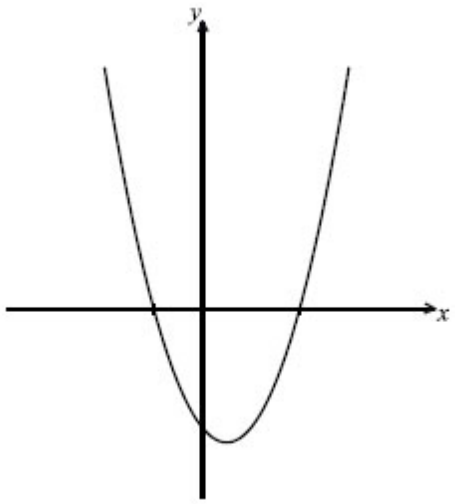
followed by

a translation of $\begin{pmatrix} p \\ q \end{pmatrix}$.

Find $\begin{pmatrix} p \\ q \end{pmatrix}$ and the value of t.

(3)
(Total 15 marks)

9. The following diagram shows part of the graph of f, where $f(x) = x^2 - x - 2$.



(a) Find both x-intercepts.

(4)

(b) Find the x-coordinate of the vertex.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(2)

(Total 6 marks)

10. Find the **exact** value of x in each of the following equations.

(a) $5^{x+1} = 625$

(b) $\log_a (3x + 5) = 2$

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 6 marks)

11. Solve the following equations.

(a) $\ln (x + 2) = 3$.

(b) $10^{2x} = 500$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 6 marks)

12. (a) Express $y = 2x^2 - 12x + 23$ in the form $y = 2(x - c)^2 + d$.

The graph of $y = x^2$ is transformed into the graph of $y = 2x^2 - 12x + 23$ by the transformations

a vertical stretch with scale factor k **followed by**
a horizontal translation of p units **followed by**
a vertical translation of q units.

(b) Write down the value of

(i) k;

(ii) p;

(iii) q.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

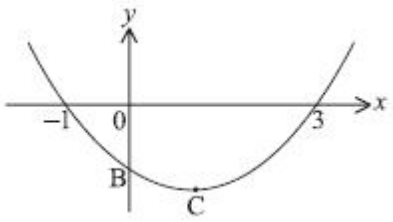
.....

.....

.....

(Total 6 marks)

13. Part of the graph of $f(x) = (x - p)(x - q)$ is shown below.



The vertex is at C. The graph crosses the y-axis at B.

(a) Write down the value of p and of q.

(b) Find the coordinates of C.

(c) Write down the y-coordinate of B.

Working:

Answers:

(a) .....

(b) .....

(c) .....

(Total 6 marks)

14. (a) Express $f(x) = x^2 - 6x + 14$ in the form $f(x) = (x - h)^2 + k$, where h and k are to be determined.

(b) Hence, or otherwise, write down the coordinates of the vertex of the parabola with equation $y - x^2 - 6x + 14$.

Working:

Answers:

(a) .....

(b) .....

(Total 4 marks)

15. The equation $kx^2 + 3x + 1 = 0$ has exactly one solution. Find the value of k.

Working:

Answer:

.....

(Total 6 marks)

16. Consider the function $f(x) = 2x^2 - 8x + 5$.

(a) Express $f(x)$ in the form $a(x - p)^2 + q$, where $a, p, q \in \mathbb{Z}$.

(b) Find the minimum value of $f(x)$.

Working:

Answers:

(a) .....
...

(b) .....
...

(Total 6 marks)